

WHAT IS CLAIMED IS:

1. A process for bleaching cellulosic fiber and producing fiber with a durable elevated curl index comprising:  
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    (a) concurrently heat-treating, bleaching and convolving cellulosic fiber pulp at elevated temperature and pressure at high consistency in a bleaching liquor; and  
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    (b) recovering said pulp wherein the length weighted curl index of the treated fiber is at least about 20% higher than the length weighted curl index of the fiber prior to said heat treatment, bleaching and convolving thereof.
2. The process according to Claim 1, wherein said step of concurrently heat-treating and convolving said fiber is carried out in a chamber in the presence of saturated steam.  
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3. The process according to Claim 2, wherein the pressure in said chamber is pulsed with respect to time.  
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4. The process according to Claim 3, wherein the localized pressure within the chamber is pulsed with respect to time.
5. The process according to Claim 4, wherein said step of concurrently heat-treating and convolving said fiber is carried out in a disk refiner provided with a rotating disk having a relief pattern operative to impart localized pressure pulses within the chamber.  
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6. The method according to Claim 5, wherein a gap between a disk of said disk refiner and an opposing surface is from about 0.5 mm to about 10 mm.
- 5 7. The method according to Claim 6, wherein a gap between a disk of said disk refiner and an opposing surface is from about 1 mm to about 5 mm.
8. The process according to Claim 1, wherein said step of concurrently heat-treating and mechanically convolving said fiber at elevated temperature and pressure includes applying mechanical shear to said fiber at high consistency.
- 10 9. The process according to Claim 1, wherein said pulp exhibits a drop in CSF of at most about 60 ml by way of said process.
- 15 10. The process according to Claim 9, wherein said pulp exhibits a drop in CSF of at most about 45 ml by way of said process.
11. The process according to Claim 10, wherein said pulp exhibits a drop in CSF of at most about 30 ml by way of said process.
- 20 12. The process according to Claim 1, wherein said pulp exhibits essentially no drop in CSF and optionally exhibits an increase in CSF.
13. An absorbent sheet incorporating fiber prepared in accordance with the process of Claim 1.
- 25 14. The process according to Claim 1, wherein the curl index of the treated fiber is at least about 30% higher than the curl index of the fiber prior to said step of concurrently heat-treating and convolving said fiber.

15. The process according to Claim 14, wherein the curl index of the treated fiber is reduced by at most about 25% by treatment at 1% consistency at 125°F in a disintegrator for 30 minutes
- 5 16. The process according to Claim 14, wherein the curl index of the treated fiber is reduced by at most about 15% by treatment at 1% consistency at 125°F in a disintegrator for 30 minutes.
- 10 17. The process according to Claim 14, wherein the curl index of the treated fiber is at least about 40% higher than the curl index of the fiber prior to heat-treating and convolving said fiber.
- 15 18. The process according to Claim 1, wherein the curl index of the treated fiber is at least about 50% higher than the curl index of the fiber prior to heat-treating and convolving said fiber.
19. The process according to Claim 1, wherein the treated fiber has a length-weighted curl index of at least about 0.12.
- 20 20. The process according to Claim 19, wherein said treated fiber has a length-weighted curl index of at least about 0.15.
21. The process according to Claim 20, wherein the treated fiber has a length-weighted curl index of at least about 0.2.
- 25 22. The process according to Claim 21, wherein said treated fiber has a length-weighted curl index of at least about 0.25.

23. The process according to Claim 22, wherein said treated fiber has a length-weighted curl index of at least about 0.3.
24. The process according to Claim 1, wherein said step of heat-treating and  
5       convolving said fiber is carried out at a consistency of from about 20% to about 60%.
25. The process according to Claim 24, wherein said step of heat-treating and  
10       convolving said fiber is carried out at a consistency of from about 20% to about 50 %.
26. The process according to Claim 25, wherein said step of heat-treating and  
15       convolving said fiber is carried out at a consistency of from about 30% to about 40%.
27. The process according to Claim 1, wherein said step of heat-treating and  
      convolving said fiber has a duration of from about 0.01 to about 20 seconds.
28. The process according to Claim 27, wherein said step of heat-treating and  
20       convolving said fiber has a duration of less than about 10 seconds.
29. The process according to Claim 28, wherein said step of heat-treating and  
      convolving said fiber has a duration of less than about 5 seconds.
- 25   30. The process according to Claim 29, wherein said step of heat-treating and  
      convolving said fiber has a duration of less than about 2 seconds.

31. The process according to Claim 1, wherein said step of heat-treating and convolving said fiber is carried out at a temperature of from about 230°F to about 370°F.
- 5 32. The process according to Claim 1, wherein mechanical energy input to said fiber during said heat-treating and convolving step is less than about 2 HP day/ton.
33. The process according to Claim 32, wherein the mechanical energy input to said fiber during said heat-treating and convolving is less than about 1 HP day/ton.
- 10 34. The process according to Claim 33, wherein mechanical energy input to said fiber during said heat-treating and convolving step is less than about 0.5 HP day/ton.
35. The process according to Claim 1, wherein said step of heat-treating and  
15 convolving is carried out at a pressure of from about 5 to about 150 psig.
36. The process according to Claim 35, wherein said step of heat-treating and convolving is carried out at a pressure of from about 10 to about 90 psig.
- 20 37. The method according to Claim 1, wherein said step for heat-treating and convolving said fiber is carried out in the presence of papermaking chemicals, one or more of which chemicals is selected from the group consisting of sulfates, silicates, hydroxides, peroxides and debonders.
- 25 38. The method according to Claim 1, wherein said step of heat-treating and convolving said fiber is carried out in the presence of an alkaline agent and a peroxide bleach.

39. The process according to Claim 1, wherein said fiber comprises secondary fiber.
40. The process according to Claim 1, wherein said fiber consists essentially of secondary fiber.
- 5 41. The process according to Claim 1, wherein said fiber consists of secondary fiber.
42. The process according to Claim 1, wherein said fiber is selected from the group consisting of Kraft hardwood fibers, Kraft softwood fibers, sulfite hardwood  
10 fibers, sulfite softwood fibers and mixtures thereof.
43. The process according to Claim 1, wherein said fibers are selected from the group consisting of mechanically pulped fibers, chemi-mechanically pulped fibers and mixtures thereof.
- 15 44. The process according to Claim 1, wherein said pulp comprises a mixture of virgin fiber and secondary fiber comprising from about 5% to about 95% by weight of secondary fiber based on the weight of fiber present in the pulp.
- 20 45. The process according to Claim 1, wherein said step of concurrently heat-treating, bleaching and convolving said pulp is carried out under conditions so as to preclude substantial fibrillation and attendant paper strength and fiber bonding development.
- 25 46. The process according to Claim 1, wherein the at least 20% elevation in the length weighted curl index of the treated fiber persists upon treatment in a disintegrator for 30 minutes at 1% consistency and a temperature of 125°F.

47. A method for producing a bleached, high bulk cellulosic fiber exhibiting a durable elevated curl index comprising:

- 5 (a) concurrently heat-treating and convolving a cellulosic fiber at high consistency with a peroxide bleaching liquor comprising a peroxide component wherein said step is carried out at elevated temperature and pressure; and
- 10 (b) recovering said fiber wherein the curl index of the treated fiber is at least about 20% higher than the curl index of the fiber prior to non-destructive refining and the elevation of the curl index so attained persists for at least 30 minutes at about 125°F at low consistency.

15 48. The method according to Claim 47, wherein said peroxide component is hydrogen peroxide.

49. The method according to Claim 47, wherein said peroxide component is selected from the group consisting of sodium peroxide, potassium peroxide and mixtures thereof.

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50. The method according to Claim 47, wherein said bleaching liquor further comprises an alkaline agent.

25 51. The method according to Claim 50, wherein said alkaline agent is sodium hydroxide.

52. The method according to Claim 47, further comprising a peroxide stabilizer.

53. The method according to Claim 52, wherein said peroxide stabilizer is a silicate.

54. The method according to Claim 52, wherein said peroxide stabilizer is sodium silicate.

5 55. The method according to Claim 47, wherein said bleaching liquor further comprises a sequestering agent.

56. The method according to Claim 55, wherein said sequestering agent is diethyltriaminopentacetic acid.

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57. The method according to Claim 47, wherein from about 4.5 to about 6 wt. % of peroxide compound is consumed per pound of dry pulp.

15 58. The method according to Claim 47, wherein said step of refining and bleaching said fiber is carried out in the presence of oxygen.

59. The method according to Claim 47 further comprising the step of subjecting the bleached and curled fiber to a reductive bleaching process.

20 60. The method according to Claim 59, wherein said reductive bleaching process is a hydrosulphite bleaching process.

61. A process for producing a bleached, high bulk cellulosic fiber exhibiting a durable elevated curl index comprising:

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(a) subjecting a cellulosic fiber to high consistency, heat-treating and convolving with a bleaching liquor selected from the group consisting of hydrosulphite bleaching liquors and peroxyacid bleaching liquors wherein



said heat treatment and convolving step is carried out at elevated temperature and pressure; and

- 5 (b) recovering said fiber wherein the curl index of the treated fiber is at least about 20% higher than the curl index of the fiber prior to non-destructive refining and the elevation of the curl index so attained persists for at least 30 minutes at about 125°F at low consistency.

62. The method according to Claim 61 wherein said bleaching liquor comprises  
10 peroxyacetic acid.

63. The method according to Claim 61, wherein said bleaching liquor comprises peroxymonosulfuric acid.

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